Sustainable Energy Strategies:

Opportunities and Challenges

SCAG Energy Team

23 May 06

Woodrow W. Clark II, MA_3Ph.D.

The Economics of Energy Sustainability

The China series:

The Economy and Its Energy Sector

Dr. Woodrow Clark

October 05

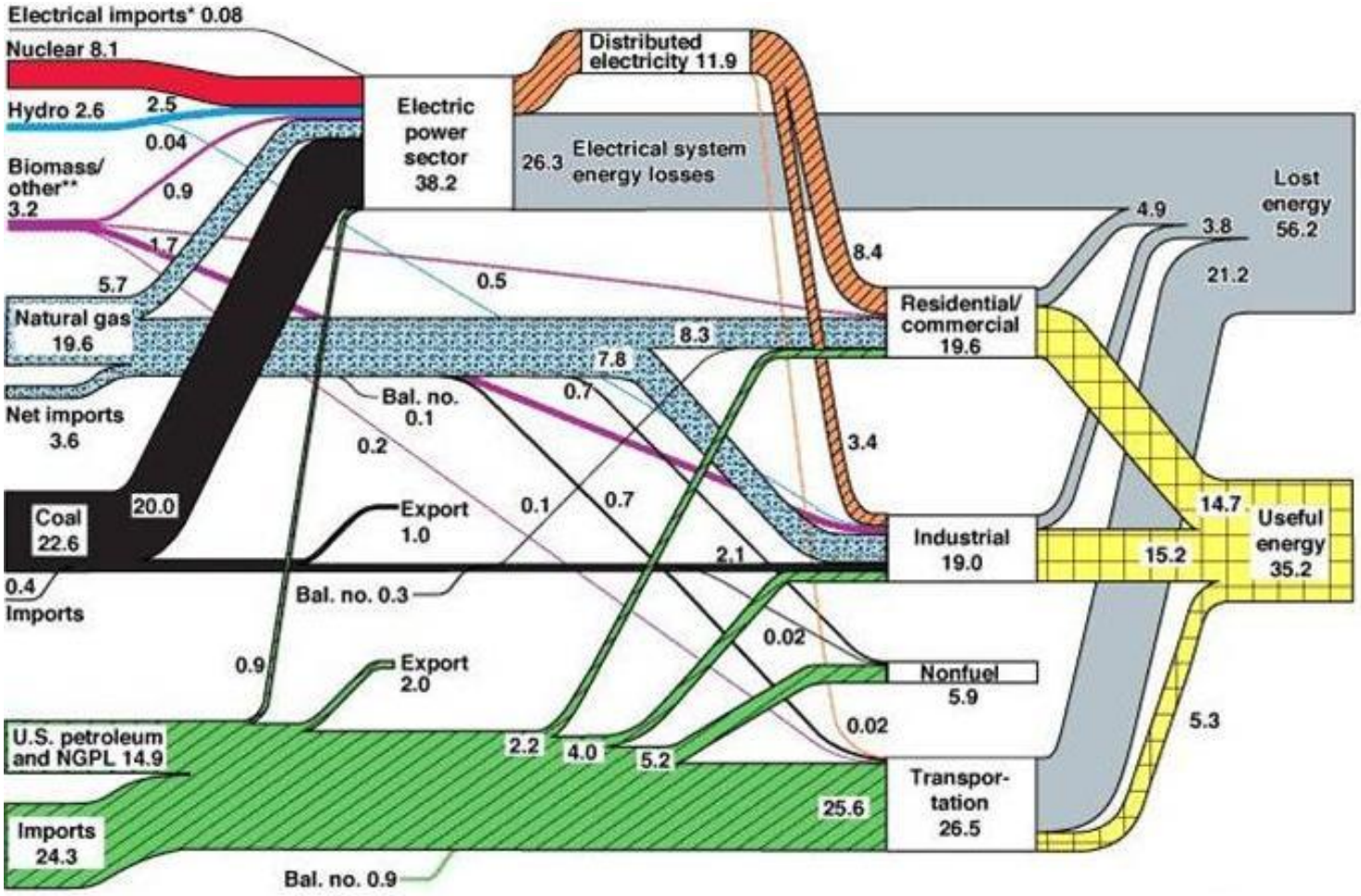
Los Angeles, CA

Burj Dubai Tower - World tallest (2008):

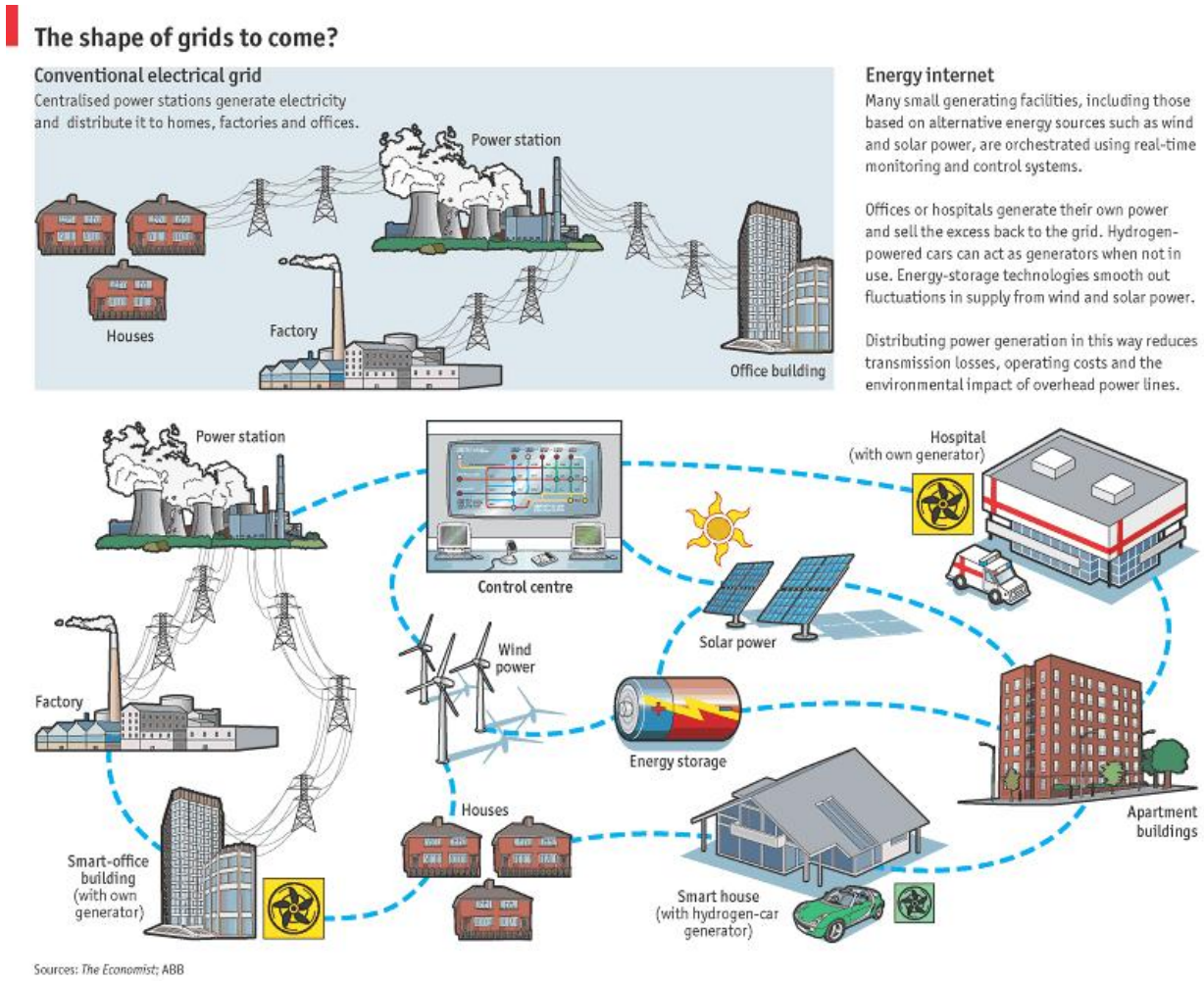
The Paradigm Shift

- Major shift in the way Global policy makers and industry frame and implement sustainability to infrastructure issues.
- Model is the move from telephone land lines to mobile/wireless; as seen in many countries not needing central grids and transmission
- Energy systems will be more “agile” meaning combination of grid and on-site generation or distributed systems at community- local levels.
- Public policy -- Set Goals e.g. RPS, Protocols, Aggregation, Specs, Master contracts, joint ventures.
- Diversification at the state and local regions of energy supplies must be through clean and renewable sources along with conservation.
- Current volatile global fossil fuel prices as well as national and international concerns for security, energy, environmental, water, climate, natural crises motivate the paradigm shift.
- Nation-States are becoming “Energy Independent” through diversified energy and environmental policies, e.g. the “Hydrogen Highway”.
- National, regional and local public policy need to use “civic market” partnerships that lead, direct, guide and evaluate the paradigm shift

Net Primary Resource Consumption ~97 Quads



Agile Energy Systems

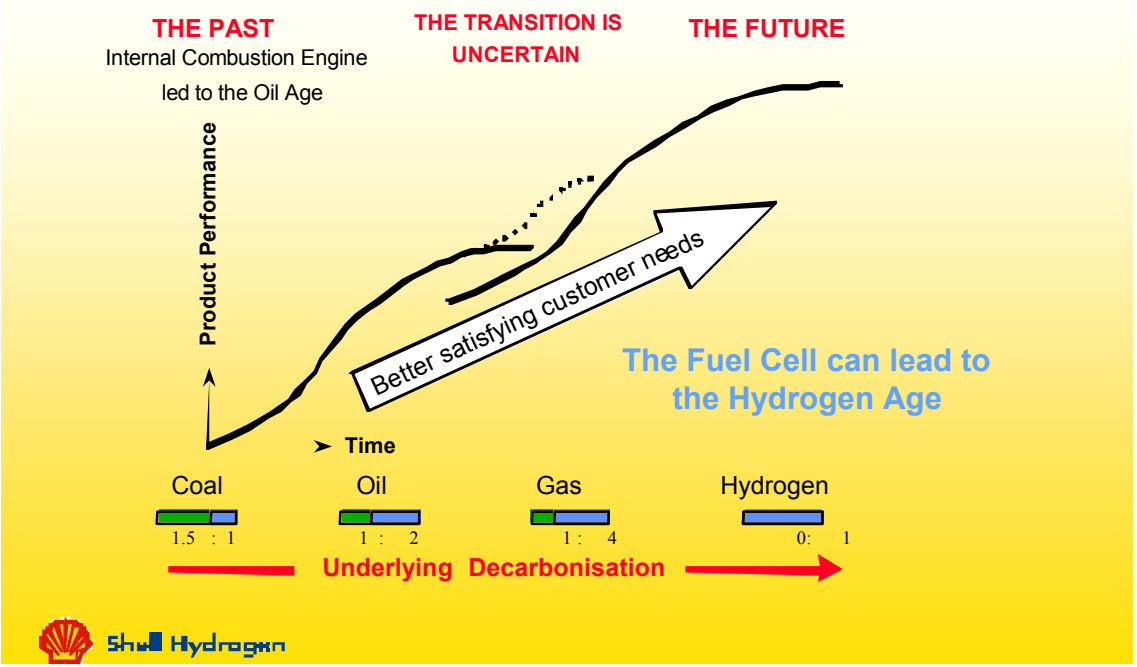


Stellar Energy Solutions

HYDROGENICS -- HYDROGEN “TOWN” IN HONG KONG

The Paradigm Change is Underway

The transition is uncertain...



Remote Market Applications

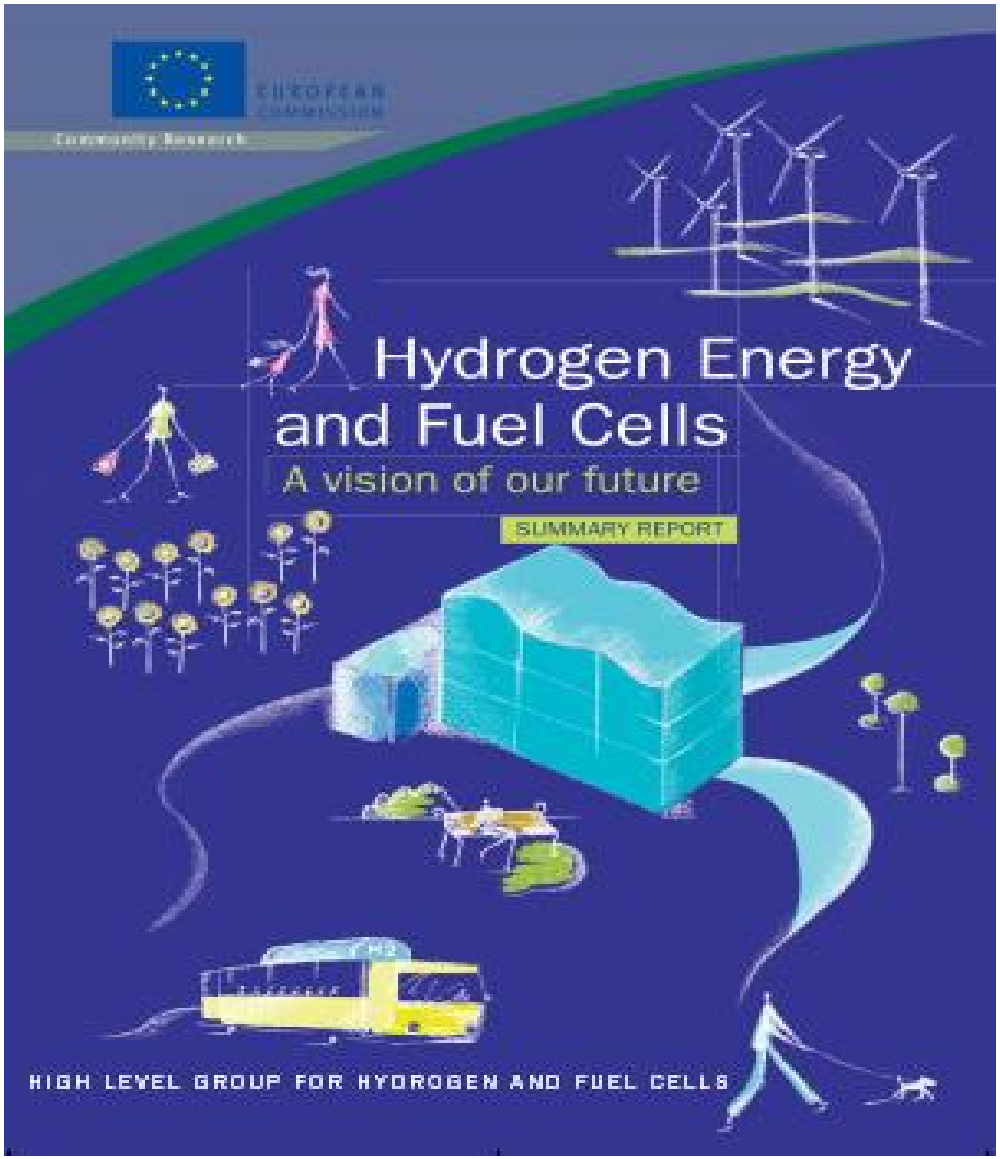
Military, Scientific and Utility

- US Air Force Alaska
- Aircraft Warning Lights for NiMO

Village Power

- 4 Alaskan Villages

Hydrogen Energy Stations:
A Global Movement



Zero Energy Homes (ZEH)

- Growing commercial market for ZEH in Japan and California
- California Million Solar Homes initiative (SB 1) 2005
- Supported in U.S. through USDOE's Building America
- Congressional Energy Bill (2005) with incentives for renewables: Solar, Wind, Geothermal, Bio-Mass, etc.
- Hydrogen Economy

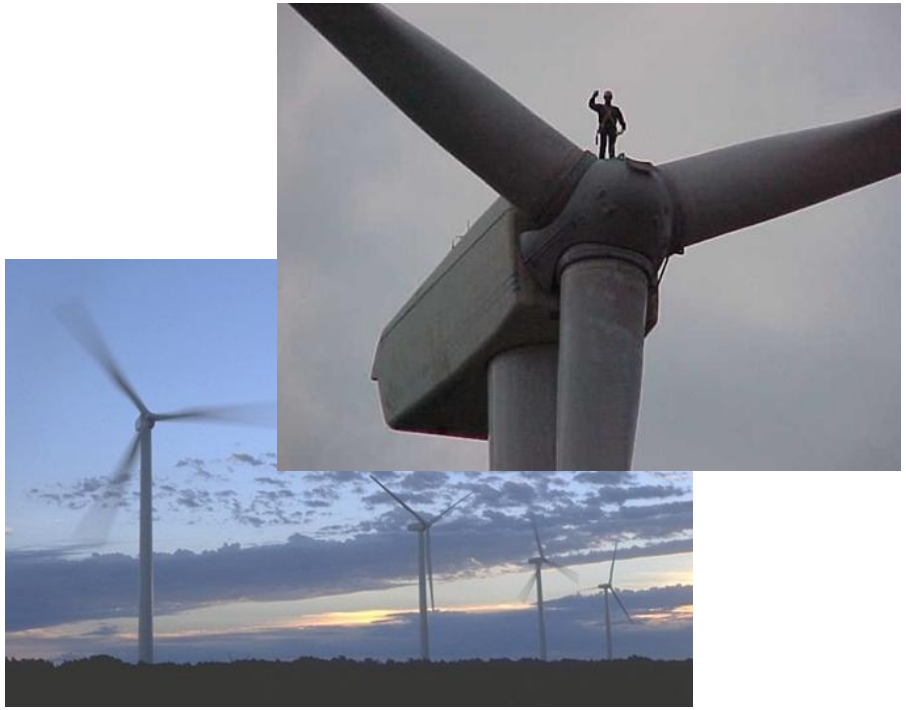
Solar / Photovoltaic Roofs

Sun Utility -- Los Angeles

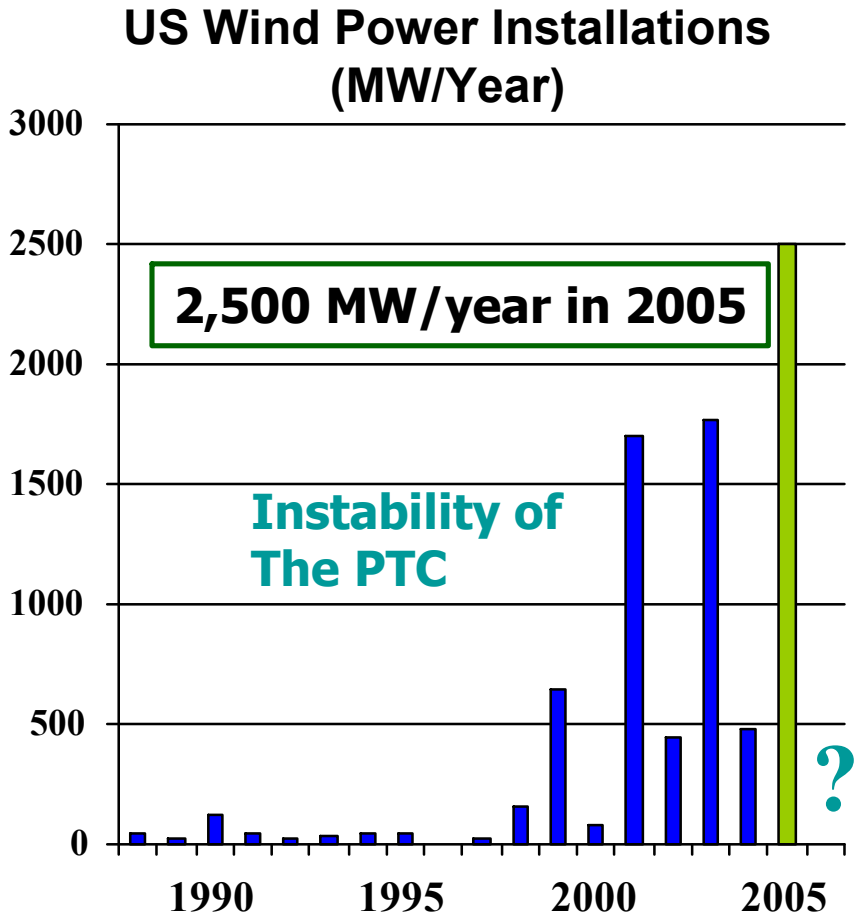
Wholesale Power Generation

US Wind Power

Wind Farm Finance Opportunity



7,200 MW Installed Base in US
48,000 MW Installed Base Worldwide



Sources: AWEA

Boston Harbor Wind Farm

Spring 05

stuartenergy
the power of hydrogen

SOLAR INTEGRATED TECHNOLOGIES

ISE Corporation
Home of ThunderVolt electric and hybrid-electric drive systems

Hydrogen – The Energy Future

- Use roof to generate renewable hydrogen
- Fleet vehicles powered by hydrogen
- Reduce California's dependence on imported petroleum

Proposed hydrogen fleet-fueling project for Frito Lay Los Angeles

Entire energy cycle is emissions free

Global Impact

Pianeta srl, Green Energy, Settimo Italy

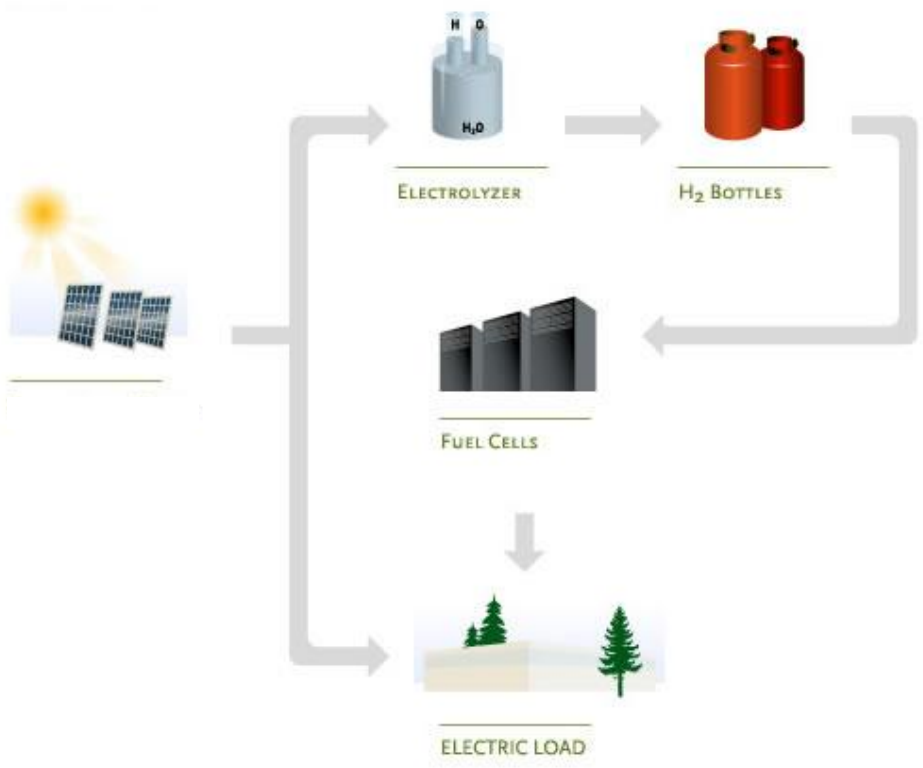
Winter Olypmics (2006)

- The main stationary hydrogen plant realized in Cesana Torinese, a little town on the Alps near Turin.
- The location, which used to be a holiday camp for the children of Italsider employees, is part of the modern architectural heritage of Piedmont Region.
- The building used to house athletes competing in the Winter Olympics at Cesana Torinese. After the Olympics it will become a hotel.
- The plant provides clean energy to certain parts of the building and fuel to vehicles.
- Created educational degree and training programs at Turin Poli-Technical University

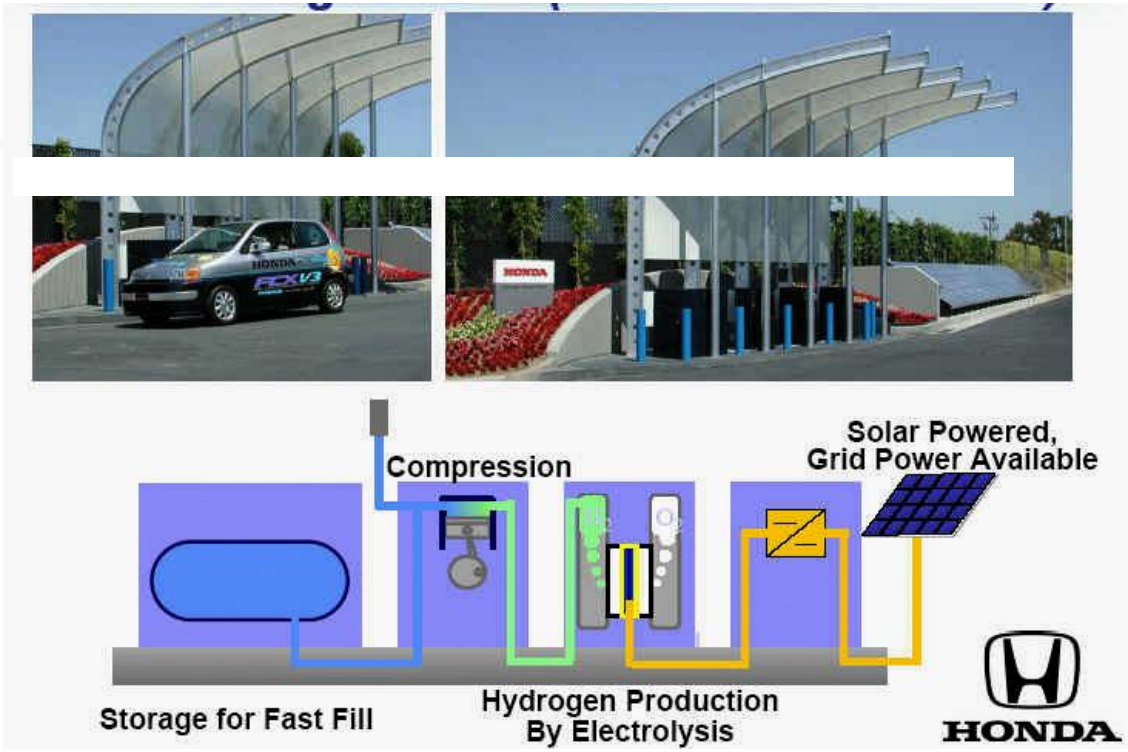
- It is the first European high mountain hydrogen plant.
- We designed and implemented all the section of the plant (H2-production, H2-storage, and H2-use) respecting the peculiar environmental and climatic conditions of the location.
- We dealt and exceeded problems like the possible freezing of the water running in some technologies and the building of the engine room according to Alps traditional architecture.

TECHNICAL DETAILS

- The electric load can be powered directly by the photovoltaic panels during the day. During the evening the energy need will be fullfilled by the fuel cells, using the clean hydrogen stocked during the day.
- Fuel cells can also work as a back-up system in case of power cut.
- Fuel cell power output: 5 kWe each. We installed 3 fuel cells.
- PV panels power peak: 25 kWe.



Honda, Torrance, CA



Follow up and Information

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